

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-6. (Cancelled)

7. (New) A method for authenticating the composition of multicomponent mixtures and/or detecting the presence of impurities in multicomponent mixtures comprising:

a. dividing the light of a broadband source of optical radiation into spectral components, and/or selecting the assigned narrow band spectral sections of the probing beam with a spectral width of Δ_i from the predetermined spectral range of wavelengths λ_i while ensuring the possibility of changing the spectral position of these sections with the assigned pitch $\Delta\lambda_i \geq \Delta_i$;

b. focusing the selected narrowband light onto a sample under analysis;

c. irradiating a sample of a known mixture K and a sample of an unknown mixture U by turns with the focused probing beam at the selected wavelengths $\lambda_1, \lambda_2, \dots, \lambda_m$ from the predetermined spectral range λ_i ;

d. collecting the probing light falling on the sample, passed through the sample or reflected by the sample to a photodetector and collecting spectral sections of the luminescent light to another photodetector;

e. measuring the intensity values of the probing light and the luminescent light collected onto the photodetectors for each of the selected wavelengths $\lambda_1, \lambda_2, \dots \lambda_m$ of the predetermined spectral range λ_i , such that, the probing light is I_0 , the light passed through a the sample or reflected by the sample is I_T , and the luminescent light of the sample is I_L , including steps of decomposition of the luminescent light into a variety of spectral sections, and/or sequential selection of the specified sections of wavelength of $\lambda_1, \lambda_2, \dots \lambda_n$ with a width of Δ_j , with the assigned pitch of $\Delta\lambda_j \geq \Delta_j$, where each section corresponds with the predetermined characteristic wavelength of the light in the predetermined spectral range λ_j , are collecting onto the corresponding photodetectors and are measuring;

f. determining the relative intensity of the collected light passed through a the sample, or reflected by a the sample, at each of selected wavelengths λ_m , and the luminescent light for each of the selected wavelengths λ_m, λ_n

for the known mixture and unknown mixture, in accordance with the following expressions:

$$T^K(\lambda_m) = \frac{I_T^K(\lambda_m)}{I_0^K(\lambda_m)}; \quad T^U(\lambda_m) = \frac{I_T^U(\lambda_m)}{I_0^U(\lambda_m)};$$

$$L^K(\lambda_m, \lambda_n) = \frac{I_L^K(\lambda_m, \lambda_n)}{I_0^K(\lambda_m)}, \quad L^U(\lambda_m, \lambda_n) = \frac{I_L^U(\lambda_m, \lambda_n)}{I_0^U(\lambda_m)}, \text{ where}$$

$T^K(\lambda_m), T^U(\lambda_m)$ - intensity values of passed or reflected light for samples of a known K mixture and unknown U mixture, normalized for the intensity of incident radiation falling on a sample at the corresponding wavelength;

$L^K(\lambda_m, \lambda_n), L^U(\lambda_m, \lambda_n)$ - intensity values of the luminescent light irradiated by a sample of a known K mixture and unknown U mixture within the specified sections $\lambda_1, \lambda_2, \dots \lambda_n$ of the predetermined range of wavelengths λ_j with light excitation within the specified sections $\lambda_1, \lambda_2, \dots \lambda_m$ of the predetermined range of wavelengths λ_i , normalized for intensity of incident radiation falling on a sample at the corresponding wavelength;

$I_T^K(\lambda_m), I_T^U(\lambda_m)$ - intensities of passed or reflected light for samples of a known K mixture and an unknown U mixture measured at the specified sections $\lambda_1, \lambda_2, \dots \lambda_m$ of the selected range of the incident light from the predetermined range λ_i ;

$I_L^K(\lambda_m, \lambda_n), I_L^U(\lambda_m, \lambda_n)$ - intensities of the luminescence radiated by a sample of a known K mixture and a sample of an unknown U

mixture measured at the selected wavelength $\lambda_1, \lambda_2, \dots \lambda_n$ of the selected range of wavelengths λ_j with light excitation within the specified sections $\lambda_1, \lambda_2, \dots \lambda_m$ of the predetermined range of wavelengths λ_i ;

$I_0^K(\lambda_m), I_0^U(\lambda_m)$ - intensity of incident probing radiation falling on an appropriate samples at the time of performing measurements;

g. comparing the corresponding relative intensity values of the light passed through the sample, or reflected by a the sample, at each of the selected wavelengths λ_m , and the luminescent light for each of the selected wavelengths λ_m, λ_n for the known mixture and the unknown mixture, and determining the compliance between the unknown mixture and the known mixture by the following expression:

$$A = \frac{1}{2} \times \left(\frac{1}{m} \times \sum_{m=1}^m \frac{T^U(\lambda_m)}{T^K(\lambda_m)} + \frac{1}{m \times n} \times \sum_{m=1}^m \sum_{n=1}^n \frac{L^U(\lambda_m, \lambda_n)}{L^K(\lambda_m, \lambda_n)} \right) = 1 \pm \delta, \text{ where}$$

m, n - the number of selected wavelengths from the predetermined spectral ranges λ_i and λ_j , respectively;

δ - a value of allowable deflections of the compared values for the unknown mixture under analysis from the corresponding values for the similar values of a standard sample of a known mixture;

h. determining the presence or absence of foreign impurities in the mixture by the following expressions:

$$C_T(\lambda_i) = \frac{T^U(\lambda_{m+1})}{T^K(\lambda_{m+1})} - \frac{T^U(\lambda_m)}{T^K(\lambda_m)}; \quad C_L(\lambda_i, \lambda_j) = \frac{L^U(\lambda_{m+1}, \lambda_{n+1})}{L^K(\lambda_{m+1}, \lambda_{n+1})} - \frac{L^U(\lambda_m, \lambda_n)}{L^K(\lambda_m, \lambda_n)},$$

whereas, if $C_T(\lambda_i) = C_L(\lambda_i, \lambda_j) = 0 \pm \delta$, there are no foreign impurities in the sample under analysis, while if there are ranges with $C_T(\lambda_i) > 0 \pm \delta$, and/or $C_L(\lambda_i, \lambda_j) \neq 0 \pm \delta$, undesirable impurities are present in the sample.

8. (New) The method according to claim 7 comprising:

- a. obtaining an electronic absorption-luminescent signature of the multicomponent mixture;
- b. comparing the electronic absorption-luminescent signatures of the sample with the electronic absorption-luminescent signature of the known mixture;
- c. preparing calibration samples which represent a specially made-up mixture or multicomponent solution of such compound, for which the absorption or reflectance spectra, and luminescence spectra of which solution (mixture) overlap with the corresponding spectra of known mixture within the predetermined analytical spectral ranges λ_i and λ_j , i.e. have nonzero intensity in the specified ranges;
- d. placing the standard sample of the known K mixture and the calibration Q sample into an analytical

device;

e. Measuring and transforming measured values for intensity of the light passed through or reflected by the standard and calibration samples, and their luminescent light, in accordance with steps a-f of claim 1, while taking into account the step of replacing the unknown U sample with the calibration Q sample;

f. creating an electronic absorption-luminescent signature ALS_K of a the standard sample as follows:

$$ALS_K = \|K_E\| = \left\| \begin{pmatrix} \frac{T_1^K}{T_1^Q} & \left(\frac{L_{1,1}^K}{L_{1,1}^Q} \right) & \left(\frac{L_{1,n}^K}{L_{1,n}^Q} \right) \\ \dots & \dots & \dots \\ \frac{T_m^K}{T_m^Q} & \left(\frac{L_{m,1}^K}{L_{m,1}^Q} \right) & \left(\frac{L_{m,n}^K}{L_{m,n}^Q} \right) \end{pmatrix} \right\|, \text{ where:}$$

T_m^K - intensities of the passed or reflected light I_T of a sample of a known K mixture, normalized for intensities of the probing light I_o , measured at the frequencies λ_m ;

$L_{m,n}^K, L_{m,n}^Q$ - intensities of the luminescence radiated by a sample of a known K mixture and a calibration Q sample, normalized for intensities of the probing light I_o , measured at the frequencies λ_n with the excitation at the frequencies λ_m ;

g. entering the electronic signature of the standard sample ALS_K into a computer database, and/or saving the electronic signature of the standard sample on an intermediate medium;

h. repeating step (e) with the sample of the unknown mixture, including the step of replacing the standard sample K with the calibration sample Q , which is strictly identical with the calibration sample used when measuring the standard sample, and creating an electronic signature ALS_U of a sample under analysis:

$$ALS_U = \|U_E\| = \left\| \begin{pmatrix} \frac{T_1^U}{T_1^Q} \\ \frac{T_2^U}{T_2^Q} \\ \dots \\ \frac{T_m^U}{T_m^Q} \end{pmatrix} \begin{pmatrix} \frac{L_{1,1}^U}{L_{1,1}^Q} \\ \frac{L_{1,2}^U}{L_{1,2}^Q} \\ \dots \\ \frac{L_{1,n}^U}{L_{1,n}^Q} \end{pmatrix} \dots \begin{pmatrix} \frac{L_{m,1}^U}{L_{m,1}^Q} \\ \frac{L_{m,2}^U}{L_{m,2}^Q} \\ \dots \\ \frac{L_{m,n}^U}{L_{m,n}^Q} \end{pmatrix} \right\|, \text{ where}$$

T_m^U - intensities of the passed or reflected light I_T of a sample of an unknown U mixture, normalized for intensities of the probing light I_0 , measured at the frequencies λ_m ;

$L_{m,n}^U$ - intensities of the luminescence radiated by a sample of an unknown U mixture, normalized for intensities of the probing light I_0 , measured at the frequencies λ_n with the excitation at the frequencies λ_m ;

i. comparing the electronic signatures of the unknown mixture $ALS_U = \|U_E\|$ being tested with similar data for the standard sample of the known mixture $ALS_K = \|K_E\|$ by the following expression:

$$\|A_{ALS}\| = \frac{\|U_E\|}{\|K_E\|},$$

such that, a conclusion on the identity of the unknown mixture and the certain mixture may be drawn when all elements of the matrix $\|A_{ALS}\|$ contain only unit elements (i.e. $a_i = a_{i,j} = 1 \pm \delta$);

j. determining the presence or absence of unwanted contaminations for the mixture under study by the following expression:

$$\|C_{ALS}\| = \frac{\|U_E\| - \|K_E\|}{\|K_E\|},$$

wherein, if the matrix $\|C_{ALS}\|$ comprises nonzero elements, the values of which exceed the value of allowable deflections from the corresponding values of the standard sample of the known mixture, $|c_i, c_{i,j}| > |\pm \delta|$, the sample under analysis is determined to contain the unwanted contaminations.

9. (New) The method according to claim 7 further comprising measuring intensity values of Raman scattering of the sample under analysis and the standard sample including the following steps:

a. irradiating the samples the unknown and the known mixture, by turns, with a monochromatic line of a narrow-band (lined) source of light at one or several selected fixed frequencies v_r ;

b. collecting the light of Raman scattering onto the photodetector device;

c. measuring the intensity of the light on each of the selected frequencies $\nu_1, \nu_2, \dots, \nu_p$ of the predetermined spectral range, collected onto the photodetector, namely: the exciting light falling on the sample I_{ex} , and the light of Raman scattering of the sample I_R , including steps of decomposition of the light of Raman scattering into a variety of spectral sections, and/or sequential selection of the specified frequency sections $\nu_1, \nu_2, \dots, \nu_p$ with a width of Δ_r , with assigned pitch $\Delta\nu_r \geq \Delta_r$, where each section corresponds to the predetermined characteristic frequency of the light in the predetermined spectral range ν_r , are collected onto the corresponding photodetectors and are measured;

d. determining the relative intensity of the collected light of Raman scattering at each of the selected frequencies $\nu_1, \nu_2, \dots, \nu_p$ for the known and unknown mixtures in accordance with the following expressions:

$$R^K(\nu_{ex}, \nu_p) = \frac{I_R^K(\nu_{ex}, \nu_p)}{I_{ex}^K}; \quad R^U(\nu_{ex}, \nu_p) = \frac{I_R^U(\nu_{ex}, \nu_p)}{I_{ex}^U};$$

where:

$I_R^K(\nu_{ex}, \nu_p), I_R^U(\nu_{ex}, \nu_p)$ - intensity values of Raman scattering radiated by a sample of a known K mixture and a sample of an unknown U mixture within the specified sections $\nu_1, \nu_2, \dots, \nu_p$ of the predetermined frequency range ν_r with light excitation at

one of the selected frequencies ν_{ex} ;

I_{ex}^K, I_{ex}^U - intensity values of the exciting light falling on corresponding samples at the time of performing measurements; e. comparing data for the mixture being tested with similar data for the standard sample of the known mixture by the following expression:

$$A = \frac{1}{2} \times \left(\frac{R^U(\nu_{ex}, \nu_p)}{R^K(\nu_{ex}, \nu_p)} \right) \times \left(\frac{1}{m} \times \sum_{m=1}^m \frac{T^U(\lambda_m)}{T^K(\lambda_m)} + \frac{1}{m \times n} \times \sum_{m=1}^m \sum_{n=1}^n \frac{L^U(\lambda_m, \lambda_n)}{L^K(\lambda_m, \lambda_n)} \right),$$

wherein the unknown mixture and the known mixture are determined as being identical if $A = 1 \pm \delta$.

10. (New) The method according to claim 8 distinguished by comparing electronic signatures containing, along with spectral profiles of absorption and luminescent intensities, spectral profiles of Raman scattering intensities for the unknown (RALS_U) and the standard sample (RALS_K) that are formed by the method of claim 3, wherein the Raman matrixes are normalized in the following way:

a. preparing a calibration sample Q_R , which calibration sample represents a specially made-up mixture or a multicomponent solution of such compound, for which the absorption or reflectance, and luminescence spectrum of which overlaps with the Raman spectrum of the known mixture within the predetermined analytical spectral ranges;

b. measuring the intensity of Raman scattering, converting the results as in steps d-h of claim 2, and forming the electronic Raman signatures of the standard sample and the unknown mixture being identified in accordance with the following expressions:

$$\|K_R\| = \left\| \begin{pmatrix} R_{1,1}^K \\ L_{1,1}^{Q_R} \end{pmatrix} \dots \begin{pmatrix} R_{1,p}^K \\ L_{1,p}^{Q_R} \end{pmatrix} \right\| \text{ and } \|U_R\| = \left\| \begin{pmatrix} R_{1,1}^U \\ L_{1,1}^{Q_R} \end{pmatrix} \dots \begin{pmatrix} R_{1,p}^U \\ L_{1,p}^{Q_R} \end{pmatrix} \right\|, \text{ where}$$
$$\begin{pmatrix} R_{q,1}^K \\ L_{q,1}^{Q_R} \end{pmatrix} \dots \begin{pmatrix} R_{q,p}^K \\ L_{q,p}^{Q_R} \end{pmatrix}$$

$R_{q,p}^K, R_{q,p}^U$ - intensity values of Raman scattering light, normalized for intensity of the exciting light I_{ex} , for samples of a known K mixture and an unknown U mixture, measured at the frequencies ν_p with light excitation at the frequency ν_q ;

$L_{q,p}^{Q_R}$ - the luminescence intensity for a calibration sample Q_R , normalized for the intensity of the exciting light I_{ex} ;

c. comparing the electronic signatures of the unknown mixture $\|U_E\|$ being tested with similar data for the standard sample of the known mixture $\|K_E\|$, including the step of comparing electronic Raman matrixes ($RALS_{U,K}$), by the following expression:

$$\|A_{RALS}\| = \left(\frac{\|U_R\|}{\|K_R\|} \right) \times \left(\frac{\|U_E\|}{\|K_E\|} \right),$$

where the identity of samples is determined by the following

attribute: $\|A_{RAIS}\| = 1 \pm \delta$.

11. (New) The method according to claim 7 wherein the sample of the mixture under analysis and the standard mixture are dissolved in appropriate solvents.

12. (New) The method of claim 7 wherein the method comprises detection of multicomponent impurities in aqueous systems.